



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|-------------|----------------------|-------------------------------|------------------|
| 10/827,331 | 04/20/2004 | Hiroyuki Kanaya | 252067US2S | 2930 |
| 22850 | 7590 | 12/29/2005 | | |
| OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314 | | | | |
| | | | EXAMINER LANDAU, MATTHEW C | |
| | | | ART UNIT 2815 | PAPER NUMBER |

DATE MAILED: 12/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/827,331

Applicant(s)

KANAYA ET AL.

Examiner

Matthew Landau

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 13 October 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-9, 11, 12 and 18-24 is/are pending in the application.
- 4a) Of the above claim(s) 3, 4, 6 and 18-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 5, 7-9, 11, 12 and 21-24 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION***Election/Restrictions***

Based on Applicant's amendment, claim 7 will now be examined with the remainder of elected claims. Also, claim 18 is no longer a linking claim, since the method could be used to make a device in which the first interlayer insulating film is SiN. Therefore, claims 3, 4, 6, and 18-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention/species, there being no allowable generic or linking claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 5, 7-9, 11, 12, and 21-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Moise et al. (US Pat. 6,534,809, hereinafter Moise).

Regarding claim 1, Figure 1 of Moise discloses a switching element 106 formed on a semiconductor substrate 102; a first interconnect layer (112/114) formed on the semiconductor substrate and having a first wiring 114 connected to one terminal of the switching element; a ferroelectric capacitor 125 formed on the first interconnect layer and having a first electrode 124 connected to the one terminal of the switching element via the first wiring; a first protective film 118 formed on the ferroelectric capacitor and the first interconnect layer; a second interconnect layer formed on the first protective film and having a second wiring 136 connected to a second

Art Unit: 2815

electrode 128/130 of the ferroelectric capacitor and a first interlayer insulating film (not shown) consisting essentially of SiO₂ (high density plasma silicon oxide) (col. 8, lines 15-20) having a dielectric constant of 4 or more; and a third interconnect layer (160/144) including at least one layer formed on the second interconnect layer having a third wiring 144 connected to the second wiring and a second interlayer insulating film 160 (SiLK or Black Diamond) (col. 8, lines 20-26) having a dielectric constant of less than 4 and being a low-k film. Note that Moise discloses a high-density plasma silicon oxide layer can be between layers 112 and layer 134 (col. 8, lines 15-20). This layer can be considered the first interlayer insulating film since it is between two layers. Regardless of this layer's exact position, it can still be considered "on" the first protective film (even if it is below the protective film). Furthermore, it is inherent that a layer of plasma silicon oxide has a dielectric constant of 4 or more.

Regarding claim 2, Moise discloses the first protective film 118 contains aluminum oxide (col. 13, lines 3-5).

Regarding claim 5, Figure 1 of Moise discloses the third interconnect layer has a second insulating film formed on the second interlayer insulating film and having a dielectric constant of 4 or more. Moise discloses a thin dielectric layer (plasma silicon oxide) is between layers 134 and 160 (col. 8, lines 15-20). This silicon oxide layer can be considered the second insulating film and inherently has a dielectric constant of 4 or more.

Regarding claim 7, Moise discloses the second and third wirings (136 and 144, respectively) consist essentially of a copper (col. 8, lines 29-31).

Art Unit: 2815

Regarding claim 8, the product-by-process limitation “wherein the second and third wirings are formed by a reactive ion etching method” does not structurally/patentably distinguish the claimed invention over Moise.

Regarding claim 9, Moise discloses the second and third wirings (136 and 144, respectively) consist essentially of aluminum (col. 8, lines 29-31).

Regarding claim 11, Moise discloses the second interlayer insulating film 134 consists of Black Diamond (col. 8, lines 20-26). It is known in the art that Black Diamond consists essentially of carbon doped silicon oxide (i.e., $\text{Si}_x\text{O}_y\text{C}_z$).

Regarding claim 12, Moise discloses the second interlayer insulating film 134 consists of SiLK (col. 8, lines 20-26). It is known in the art that SiLK inherently includes a C_xH_y structure.

Regarding claim 21, as stated in the above rejections, Moise discloses the first interlayer insulating film is high density plasma silicon oxide and the second interlayer insulating film is SiLK. It is inherent that the high density plasma silicon oxide of the first interlayer insulating film has a higher density than the SiLK of the second interlayer insulating film.

Regarding claim 22, the limitation “wherein the first interlayer insulating film suppresses diffusion of hydrogen which intrudes from above” is merely a recitation of intended use that does not structurally distinguish the claimed invention over the prior art. The first interlayer insulating film (plasma silicon oxide) of Moise is inherently capable of suppressing diffusion of hydrogen, to at least some degree.

Regarding claim 23, Figure 1 of Moise discloses the ferroelectric capacitor 125 includes a lower electrode 124, a ferroelectric film 126 provided on the lower electrode, and an upper 128/130 electrode provided on the ferroelectric film.

Art Unit: 2815

Regarding claim 24, Moise discloses the ferroelectric film is composed of PZT (col. 9, lines 54-58).

Response to Arguments

Applicant's arguments filed October 13, 2005 have been fully considered but they are not persuasive.

Applicant argues that "Moise does not disclose the claimed configuration of a plasma SiO₂ film and a low-k film as described in Claim 1". As explained in the above rejection, Moise discloses a plasma silicon SiO₂ film can be formed between layers 112 and layer 134, and that this layer can be considered the first interlayer insulating film. Regardless of the position of this film relative to the protective film 118, it can still be considered "on" the protective film, since the term "on" does not necessarily imply being above or in contact with. Applicant further argues that Moise does not disclose or suggest the protective film of claim 2, which includes a metal oxide. As explained in the above rejection, layer 118 is considered the protective film, and Moise discloses layer 118 is aluminum oxide. Note that the second interconnect layer can be considered "on" the protective film 118 since the term "on" does not necessarily imply direct contact.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO**

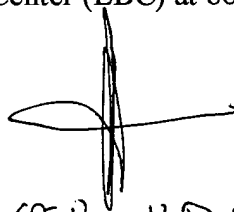
Art Unit: 2815

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (571) 272-1731.

The examiner can normally be reached from 8:30 AM - 5:30 PM. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kenneth Parker can be reached on (571) 272-2298. The fax phone numbers for the organization where this application or proceeding is assigned are (571) 273-8300 for regular communications and (571) 273-8300 for After Final communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should any questions arise regarding access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Matthew C. Landau

SPE Kenneth Parker
722800

December 16, 2005